Report of the 2005 meeting of the URA Visiting Committee for Fermilab
April 22-23, 2005

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1 Introduction

The 2005 Visiting Committee of the Universities' Research Association (URA) reviewed the Fermilab program on April 22-23, 2005. The Appendix of this report includes the charge to the committee from the URA, and the meeting agenda.

In the executive summary, below, the principal conclusions and recommendations of the review are presented, in the form of specific responses to the first four items in the charge. The main body of the text addresses the state of the Laboratory, its research programs, and future plans, following the order of the items in the meeting agenda.

2 Executive Summary

2.1 General Laboratory operation and accomplishments since the last review

The committee would like to commend the director and the Laboratory

- on the excellent performance of the collider accelerator complex over the past year, and on the transformation of this performance by the CDF and D0 collaborations into new physics results.
- on the development of a world class neutrino program in NuMI/MINOS and MiniBooNE, which will break new ground in addressing key issues in neutrino physics.
- on the creation of the Particle Astrophysics Center, which forms a home for the Laboratory's diverse and very successful programs in experimental and theoretical particle astrophysics.
- on continuing to improve the excellent safety record of the Laboratory.

2.2 Specific comments and reflections from the committee on the first four items from the charge.

i) **How effectively is the Laboratory dealing with Collider Run II issues (both accelerator and detector performance)? How realistic are the Laboratory's Run II goals in relation to current and expected collider performance?**

   – The Laboratory has successfully addressed the near term Run II issues. As a result of sustained and focused efforts over the past two years, the performance of both the accelerator and detector in Run II is currently at an extremely high level.

- The committee recognizes the challenges ahead of the Laboratory in meeting its design goals for future luminosity performance. These include successful operation of the electron cooling system in the Recycler, continued progress in increasing antiproton flux into the Accumulator, successful implementation of the Accumulator stack tail upgrade, and implementation of rapid transfers between the Accumulator and the Recycler.
- The committee notes that much more information about the performance of the electron cooling system will be known by the fall, at which time the feasibility of the design goals will be able to be evaluated much better.
- The committee is concerned that improvements to the antiproton stacking rate, which are key to meeting the design goals, have been developing more slowly than originally planned. The Laboratory may wish to focus increased attention on this area.
- The committee is pleased to see the increase in the number of published physics results from both CDF and D0, and looks forward to even more results in the coming year.
- The committee is gratified that detector operations for both experiments have been stable and efficient. CDF is to be commended for beginning a process of renewing MOUs with university groups for the next 2 years
- The committee urges both CDF and D0 to optimize detector operations for efficiency and maintainability for the remainder of Run II. The committee recommends that both collaborations undertake a 5 year planning exercise, to estimate the manpower requirements for detector operations and physics analysis. This exercise should consider the availability of collaboration manpower over the same period, particularly during the period of the LHC startup
- The committee would like to hear from both CDF and D0, at the next annual review, the results of detailed studies of detector performance and efficiency under the design accelerator scenario, in which weekly delivered luminosity will triple from present levels.
- The R&D activities of the Computing Division are well focused and take advantage of the strengths of the division. The development of computing resources based on tightly coupled off-the-shelf computers to be used for lattice QCD, fine grained accelerator physics simulations, and collider detector data analysis, is making excellent progress.
- The development of middleware to make effective use of grid computing resources is going well. The efforts of the group to develop standards and protocols through the open science grid consortium to make all of the grid projects

usable are an important contribution. Increased effort may be needed to resolve the current incompatibilities with the European grids.

- **How effectively is the Laboratory meeting the requirements of the MiniBooNE and MINOS neutrino experiments**

  - The committee congratulates Fermilab on the delivery of more than 5×10^{20} protons to MiniBooNE. This accumulated data should provide a very good basis for validating or ruling out the LSND anomaly. The committee supports the decision to wait until the result is known before making future plans beyond 2006 for MiniBooNE.
  - The committee applauds the completion of NuMI/MINOS construction and the first events detected in MINOS.
  - Fermilab is conducting an impressive neutrino program. The formation of the neutrino department is an appropriate step to help structure this program and support the collaborations and the scientific evaluation.
  - The committee recommends that the proton plan be developed in more detail, including the best projection of the ultimate proton capability without the proton driver.
  - The committee feels there is a strong case for a long baseline, off axis neutrino oscillation experiment, so it is pleased that the Lab is pursuing the NOνA experiment. This experiment could begin searching in uncharted territory in a timely way, and the neutrino flux will become even better with time, especially when the Tevatron completes the collider program and additional protons can be directed to the neutrino target.
  - The committee believes that MINERνA promises interesting physics at a low cost. It will be beneficial to the overall program studying neutrino oscillations.

- **Are the Laboratory's R&D and long-range planning activities appropriately matched to future opportunities, especially in view of the technology decision for the proposed International Linear Collider?**

  - The committee recommends that Lab pursue R&D on International Linear Collider RF technology vigorously. The Superconducting Module and Test Facility program at FNAL has made an excellent start by ramping up to significant activity in ~ 6 months. This has been made possible by an increased ILC budget resulting from the redirection of funds.
  - The committee finds that impressive progress has been made since last year on the proton driver, in the areas of technology development, design studies, and physics motivation.

- The committee recommends that the Laboratory establish more clearly the relative priority of ILC R&D and linac proton driver R&D, and articulate clearly and consistently that priority. Clarifying the differences between SCRF R&D required by the two projects would be useful.
- Fermilab has been designated the U.S. site for an American bid to host the ILC. To fully capitalize on this unique opportunity, the committee urges the Laboratory director to work with Fermilab and the U.S. HEP community to develop and articulate more fully a comprehensive strategy for bringing the ILC to the U.S. and to Fermilab on the time scale of a construction start around 2010.
- U.S. CMS, centered here at Fermilab, is making very strong contributions to CMS, especially in the silicon detector production and integration. The silicon detector facility here at Fermilab, combined with two additional assembly sites, has enabled this. Automation of the wire bonding process will make it possible to complete the assembly of the barrel silicon detector system.
- Scientists from the Laboratory have been appointed to high level management positions in the computing and data analysis groups of CMS, which is a very strong indication of the importance of the Fermilab contribution to these crucial activities.
- The establishment of the LHC Physics Research Center (LPC) on the 11^{th} floor of the high rise provides a strong focus for extracting physics from the CMS detector. When considering the location of the proposed remote operations center, it is important that it be located near or within the CMS Physics Research Center. There could be a strong advantage in combining the detector and accelerator activities in the operations center

- **Is the Laboratory's astrophysics program evolving in a coherent manner?**
  - The committee applauds the appointment of Rocky Kolb as the director of the new Particle Astrophysics Center at FNAL. The committee expects that the attractive variety of present and future particle astrophysics experiments, housed under the umbrella of the Center, will further enhance FNAL's stature as an international leader in particle astrophysics.
  - To insure that the FNAL particle astrophysics groups fully reap the benefits of their extensive and high quality investments in SDSS, CDMS and Auger, the committee recommends that FNAL management take a more aggressive approach hiring particle astrophysics postdocs. The goal should be to increase the number of Fermilab postdocs working in the analysis of data from these high profile particle astrophysics experiments, with the hope that this would increase Fermilab's visibility in these discoveries.

– Last year's committee had hoped to see improved interaction between the Theoretical Particle Physics and Theoretical Astrophysics groups. The two groups will soon move apart geographically. Perhaps a small step to improve the interaction would be to institute a ∼monthly joint particle/astrophysics theory seminar.
– The theoretical astrophysics group is very good and very productive, but has a retention problem, which is understandable, in light of the quality bar. The group should continue to hire young scientists, as the age distribution of this group is skewed toward higher ages.

3 Collider Run II

The principal element of the Collider Run II Upgrade plan is an increase in the number of antiprotons available to the collider, through

- an increase in the proton beam intensity on target (via slip stacking)
- an increase in the antiproton collection efficiency (via aperture improvements)
- an increase in the stacking capability (via improvements to the Accumulator stack tail cooling system)
- an increase in the antiproton storage capacity (via implementation of electron cooling in the Recycler)

In addition, improvements will be made to the Tevatron: alignment and repair of the dipoles, additional separators for improved helix separation, and the use of active beam-beam compensation.

This plan has been in execution for more than a year. Digital dampers have been implemented in the Main Injector. Slip stacking has been commissioned, and operation with slip-stacked beam has resulted in an increase in the antiproton stacking rate to > 16 mA/hr. Improvements have been made to the antiproton targeting and collection systems. Detailed design and planning has started for the stacktail cooling upgrade.

The electron cooling system has been installed in the Recycler, and commissioning of this system has begun. With the improvements in its vacuum system, the Recycler has become a useful and important operational element in the collider complex. Mixed-source operation, with antiprotons being supplied from both the Accumulator and the Recycler for a single Tevatron fill, has yielded the highest peak luminosities to date.

Major reliability improvements, including realignment of many of the Tevatron dipoles, have been made throughout the complex. Two additional separators have been installed and commissioned, which will provide a 15-20% increase in the helix separation. Implementation of a new BPM system for the Tevatron is underway, which will be very useful in understanding some of the limitations to luminosity.

The Run II upgrade plan has been quite successful to date. Since the last review by this committee, the Tevatron collider has made enormous improvements, both in terms of integrated and peak luminosity. The peak luminosity has increased by more than a factor of two over the last year. The committee offers its congratulations to the director, the Accelerator Division, and the Laboratory, on this excellent performance.

The committee recognizes the challenges ahead of the Laboratory in meeting its design goals for future luminosity performance. These include successful operation of the electron cooling system in the Recycler, continued progress in increasing antiproton flux into the Accumulator, successful implementation of the Accumulator stack tail upgrade, and implementation of rapid transfers between the Accumulator and the Recycler.

The committee notes that much more information about the performance of the electron cooling system will be known by the fall, at which time the feasibility of the design goals will be able to be evaluated much better.

The committee is concerned that improvements to the antiproton stacking rate, which are key to meeting the design goals, have been developing more slowly than originally planned. The Laboratory may wish to focus increased attention on this area.

4 Accelerator R&D at Fermilab

4.1 ILC and Linac Proton Driver (SCRF) R&D

The August 2004 recommendation by the Linear Collider International Technology Recommendation Panel (ITRP) that the future International Linear Collider (ILC) be based on 1.3 GHz superconducting RF technology has focused Fermilab's commitment to ILC-based R&D.

The committee recognizes the rapid development of plans (and implementation) of the Superconducting Module and Test Facility (SMTF). The SMTF is a collaboration between several institutions (FNAL, Cornell, JLab, ANL, LBNL, LANL, MIT, MSU, SNS, UPenn, NIU, BNL, SLAC), with Fermilab coordinating and hosting the facility. The goal of the SMTF is to "develop U.S. capabilities in high-gradient superconducting accelerating structures in support of the ILC and other projects of interest to U.S. laboratories". The facility itself will focus on the necessary infrastructure for the construction of SCRF modules (cavity preparation, string assembly, final module assembly), and a module test facility (linac), to be housed in the Meson detector building. The committee noted that the facility had made an excellent start, ramping up to a significant activity in little over six months. This has been made possible in part by redirection of funds within Fermilab.

By hosting SMTF, Fermilab will be expected to assume a major U.S. coordination role in the development efforts to build up SCRF production and operational capability in the U.S. In so doing,

- Fermilab should play a leading role in creating a clear definition of the baseline designs for the ILC SCRF systems, in the collaboration under the ILC Global Design Effort (GDE) and with international/national partners.
- Fermilab should work vigorously with other U.S. collaborators to draft an optimum set of role definitions and tasks centered around SMTF, in a manner consistent with the GDE timelines and available resources.
- Fermilab should also help other U.S. partners to coordinate recruitment and training of a new influx of accelerator physicists and engineers, in a wide range of design and development efforts pertaining to ILC.

The committee strongly recommends that Fermilab continue to ramp up and vigorously pursue the necessary R&D to establish a base of expertise with the U.S. for the SCRF linac technology required by the ILC and other projects.

The choice of the cold technology consolidates the plans made by the Fermilab Long Range Planning Committee (FLRPC) in 2003 (and supported by this committee in its 2004 report). The committee agrees with and supports the decision to base the linac Proton Driver on the same SCRF linac technology as that for the ILC, in view of the obvious advantages in parallel development. The committee notes the impressive progress over the last year on developing the accelerator plans and the physics case for the Proton Driver. The linac version of the Proton Driver will require approximately 50 $\beta = 1$ cryomodules which will be very similar to those required by the ILC ($\sim$ 4000 cryomodules).

The committee notes the potential for the linac Proton Driver to act as a prototype for the ILC, allowing a solid foundation for U.S. based industrial studies and risk reduction. However, some concern was expressed about the projected time-scales, which currently have the Proton Driver construction and operation after the ILC goal for start of construction in 2010. The committee acknowledges the plans to pursue the Proton Driver on these time-scales in the event of the ILC being either delayed or constructed elsewhere. However, the committee also feels that Fermilab needs to clearly establish the relative priorities of ILC R&D versus linac Proton Driver R&D, and to clearly and consistently articulate those priorities. Clarifying the differences between the SCRF R&D required by the two projects would be useful.

Given that Fermilab has been designated the U.S. site for an American bid to host the ILC, the committee strongly recommends that the Fermilab Director fully capitalize on this unique opportunity by working closely with Fermilab itself and the U.S. HEP community, to develop and articulate more fully a comprehensive strategy for bringing the ILC to Fermilab on the time scale of a construction start early 2010. The committee notes and fully supports the Laboratory's plans for the Fermilab ILC site development, as requested by the GDE director.

4.2 ILC specific R&D

In addition to the SCRF linac R&D, the committee acknowledges and supports Fermilab's commitment to establishing an R&D base in other ILC subsystems. Specifically, this includes R&D on fast kicker technology for damping rings, and general damping ring design; beam dynamics simulation work on emittance preservation in the main linacs; studies (simulations) of instabilities in the damping rings; post-linac collimation system studies and estimations of detector backgrounds (machine detector interface); and electron sources. Within the framework of the Fermilab site development, Fermilab continues to be active in civil facilities and vibration measurements. The committee strongly endorses an active outreach program, extending from universities to local, state and federal government, as well as funding agencies. The committee acknowledges that the ILC is a global project, and that Fermilab is making extensive efforts to form collaborations with other laboratories within the context of the GDE.

4.3 Linac Proton Driver Specific R&D

While most of the Proton Driver linac is fundamentally identical to the ILC main linac (based on TESLA technology), the front end where $\beta < 1$ requires a fast ferrite $E-H$ tuner to handle the rapidly changing velocity of the protons as they are accelerated. Fermilab began development of this tuner last year, and since then two prototypes have been successfully tested to the required specification, and one is now on order from a commercial source. The cavities themselves for the $\beta < 1$ linac are a modified form of the TESLA (ILC) cavities and require additional R&D. These cavities have similarities to designs for JPARC and RIA, and these can be used to minimize the necessary R&D. The plans are to develop these crucial front-end linac components as part of the SMTF program. While the committee acknowledges the need for this R&D, clear priorities should be set with respect to the ILC main linac ($\beta = 1$) SCRF.

4.4 Superconducting Magnet R&D

Fermilab continues to maintain its expertise in the field of superconducting magnets, primarily through R&D for LHC, and its future upgrade. Fermilab's commitment to supplying the LHC IR quadrupoles is well underway, with many of the required cold-masses having been successfully tested and shipped to CERN. The committee acknowledges the excellent performance of these magnets, with 16 of the 18 having achieved the very demanding performance specifications. The committee notes the concern over the currently unknown reasons as to why the two remaining magnets failed to reach the design current.

The committee acknowledges the leading role played by Fermilab for the U.S. LHC project, a successful collaboration between Fermilab, BNL, and LBNL, to design and build four high-luminosity IR regions for LHC. This project should be complete by December 2005, with the delivery of all required quadrupoles to CERN.

The committee also notes the excellent progress made on high-field magnets based on Nb_3Sn technology, to be used for designs of the LHC upgrade IR quadrupoles. The material shows excellent promise as a high-field superconductor, but the mechanical characteristics require novel fabrication techniques. The high field magnet program has been on-going at Fermilab since 1998, with several promising construction techniques being pursued in parallel. The program is part of the overall LHC Accelerator Research Program (LARP), which will maintain Fermilab's (and the U.S.) role within the LHC program during commissioning, operation and future upgrades. The committee strongly endorses these activities.

4.5 Neutrino Factory R&D

With a view to long-term accelerator R&D, Fermilab is one of the three lead-laboratories for the National Neutrino Factory and Muon Collider R&D Collaboration. Fermilab hosts the R&D program to study technology related to muon ionization cooling channel (MUCOOL program), which is one of the major challenges to any future neutrino factory / muon collider facility. The committee acknowledges the findings of the APS Neutrino Study, which strongly endorsed R&D towards neutrino factories. The committee notes and supports both the on-going MUCOOL activities at Fermilab, and Fermilab's participation in the recently approved MICE experiment at RAL, UK. The committee appreciates that these activities represent a low-level effort, which is maintained as funding permits.

5 Collider detectors

5.1 CDF Program

CDF has recorded ~ 700 pb^{-1} in Run II, and is now operating smoothly with 75-85% data taking efficiency. The Central Outer Tracker (COT) aging problems of last summer are solved, and the gain has been restored to the original value. The Run IIb upgrades are coming along on schedule, with some already installed and others scheduled for installation this summer or fall. None of these installation requires access. The effort required for ongoing maintenance is substantial, and CDF has initiated a process of renewing MOU's with collaborating institutions for the next two years to ensure that all tasks are covered.

From the Run II data, CDF has 14 published results, 13 completed results that are submitted or accepted for publication, and 31 more results in internal review. FNAL authors contributed to 10 of the 27 completed publications. These results include the world's most precise top mass measurement, the first Run II B_s mixing result, and many more results in B physics, top physics and searches for new physics.

The FNAL group on CDF consists of 63 authors, or about 10% of the collaboration, making it the single largest group in CDF. FNAL has held many leadership roles in CDF, especially in analysis and computing, as well as providing the project leader for Run IIb and a recently elected spokesperson. The FNAL group has line responsibility for safety, computing, the COT, the silicon vertex detector, the online DAQ, and the L2 trigger upgrade.

5.2 D0 Program

D0 is currently running with 80-90% data taking efficiency and has 670 pb^{-1} on tape, out of 810 pb^{-1} total delivered since the start of Run II. The D0 detector is operating well, with 98% good channels in the fiber tracker and 99.9% in the calorimeter. The silicon vertex detector performance is stable, with no evidence for radiation damage. A new inner layer, L0, is under construction and will be installed in Fall 2005. This will be important in the future as L1 is expected to be the first to fail due to radiation effects. A calorimeter trigger upgrade is also in progress, as well as new front-end electronics for fiber tracker.

D0 has a total of 22 publications from Run II, and 74 new results have been internally approved for conferences. Highlights include an improved top quark mass and cross section measurements, the world's best limit on the cross section for single top and on the rare decay $B_s \to \mu^+\mu^-$, and many searches for new physics, including extra dimensions and supersymmetry.

The FNAL group makes up about 10% of the total D0 collaboration, with 61 members. They make strong contributions to operations, computing, upgrades and physics analysis; 25% of physics analysis group convenors currently come from the FNAL group.

5.3 Issues for both CDF and D0

Ongoing detector maintenance and operations is a concern for both experiments, since many CDF and D0 collaborators are participating in LHC experiments and will begin dividing their time between FNAL and CERN as the time for LHC turn-on approaches. The LHC Physics Center at FNAL will allow those who are working on CMS to come to FNAL for work on both CMS and the Tevatron experiments, but there is no similar option available for those participating in the ATLAS experiment. It would be prudent for FNAL management to determine how many D0 and CDF collaborators are participating in CMS or ATLAS, and to get some estimate of how much manpower will be available for routine operations and maintenance as well as for physics analysis over the next five years. Ideally, MOU's would be established for both experiments covering the next five year period.

Luminosity projections show that the weekly integrated data delivered by the Tevatron will triple. The visiting committee did not have time to review the planning both experiments have done to ensure that the experiments can handle the data rate and associated radiation levels, as well as the computing resources that will be required. This would be a good topic for next year's visiting committee to learn more about.

6 U.S. CMS

U.S. CMS, centered at Fermilab, continues to make very strong contributions to CMS. New U.S. institutions are continuing to join the CMS collaboration, indicating its strong attraction. In the past, Fermilab has been heavily involved in the hadron calorimeter system, the muon end cap detector system, the filter and event builder for the trigger and data acquisition system and the support and assembly of the pixel system in the tracker. Recently, with the reorganization of the silicon tracker system with Peter Sharp as the project manager, the overall project management and coordination has improved. The outer barrel tracker for the silicon tracker system is now nearly back on schedule and should be delivered to CERN in the September time frame for final integration into the silicon tracker. The silicon detector facility here at Fermilab, combined with two additional assembly sites, has enabled this. In addition, a Fermilab person is now deputy head of the forward pixel detector system, which is to be installed during the first shutdown after initial operation of the LHC.

As preparations continue for doing science at the LHC, Fermilab is again playing a leading role. Dan Green, who has served as the project manager for the U.S. CMS construction project, is now the project manager for the research program. This program includes the U.S. share of providing software and computing for data analysis and maintenance and operation of the detector. Scientists from the Laboratory have been appointed to high level management positions in the computing and data analysis groups of CMS, which is a very strong indication of the importance of the Fermilab contribution to these crucial activities. They will play a crucial role in developing the Physics TDR that is due this fall. One major concern is that, in the current budget guidance for the research program, the management reserve does not cover the recent currency fluctuations, leading to significant increases in the cost of maintaining personnel in Geneva. More support will be needed to cover this.

The establishment of the CMS Physics Center on the 11^{th} floor of the high rise provides a strong focus for extracting physics from the CMS detector. The overall layout, the video conferencing capabilities, and the provision of working areas for university based collaborators to participate in detector operations and data analysis, is well conceived. When considering the location of the proposed CMS remote operations center, it is important that it be located near or within the CMS Physics Center. There could be a strong advantage in combining the detector operations and accelerator operations activities in the new center.

The establishment of the Tier 1 computing center at Fermilab is an important step in being able to make effective use of the data coming from CMS. It builds on the expertise developed by the computing division in handling the very large volumes of data coming from CDF and D0. With this experience, there should be a smooth transition to being able to manage the data stream coming from CMS.

Overall, Fermilab is to be commended for the contributions that it has made to the CMS detector. The experience gained in the analysis of data from both D0 and CDF by the people that are beginning to migrate to CMS will be invaluable in getting the analysis of CMS data off to a running start. This places the U.S. and Fermilab in a strong position to be the major force in the physics output from the CMS collaboration.

7 Proton Plan

The committee heard Fermilab's report on its planning efforts for upgrades and operational improvements for the proton delivery system, including both the NuMI beamline (120 GeV from the Main Injector) and the Booster Neutrino Beam (BNB, 8 GeV from the Booster). The proposed plan takes a long-term, four-stage approach, which spans the period beyond the end of Tevatron operation, including the Proton Driver runs in $\sim$ 2015 or beyond. The execution scenario for this plan is in place, with a well-defined organization and associated support structure, annual budget guidance, and schedules.

The committee understands that the proposed plans will be discussed at a workshop scheduled in summer, 2005. Through interactions with Laboratory management, a set of coherent Laboratory policies will emerge.

The committee observes that

- Attention should be paid to the allocation of accelerator operation time for machine development, including system commissioning, diagnosis and development of operational procedures, in synchronization with each step of the proposed upgrade.
- On the same note, adequate mobilization of human resources, such as accelerator physicists and engineering experts, despite the workload stemming from other project requirements, should be an integral part of the overall long-term laboratory planning.
- The serviceability and availability of 200 MW power tubes for use in MI operation could be a potentially serious concern. The efforts by the Working Group charged to draft a plan for this issue should draw maximum possible support from Laboratory management.

8 Neutrino Experiments

8.1 MiniBooNE

The MiniBooNE program is specifically intended to address the Los Alamos observation of neutrino family oscillation (LSND anomaly). In the Liquid Scintillator Neutrino Detector (LSND) experiment, muon antineutrinos appear to convert to electron antineutrinos over a short path. This observation does not fit into the current understanding of neutrinos, which implies that there are three and only three light neutrinos that interact with matter. A positive result by MiniBooNE will indicate a fundamental flaw in our present understanding of neutrinos. A possible theoretical interpretation would imply the existence of a sterile neutrino. This would have important consequences for our fundamental understanding of particle physics and for the evolution of the Universe.

The success of the neutrino experiments at Fermilab depends greatly on the integrated number of protons on target to provide the neutrinos for MiniBooNe. By April 2005, Fermilab has been successful in delivering more than 5×10^{20} protons to MiniBooNe. More than 500,000 neutrino interactions have been recorded. The committee congratulates Fermilab on this success in the accumulated protons on target (POT) to date.

The accumulated data in MiniBooNe should provide a good basis for validating or ruling out the LSND observation. The primary signal event for an LSND phenomenon would appear as a single final state electron from a charged current electron neutrino process. The committee supports the decision to wait until the result is known before making future plans beyond 2006 for MiniBooNE. To quote the APS neutrino study: "a decisive resolution of this question is essential".

8.2 NuMI/MINOS

The NuMI/MINOS experiment explores physics beyond the standard model by observing both the disappearance of muon neutrinos, and the appearance of electron neutrinos. The former will confirm the existence of atmospheric neutrino oscillation and narrow the allowed Δm^2_{23} region, and the latter will discover or set upper limits on $\sin^2 2\theta_{13}$. MINOS measures the delivered neutrino beam with a near and a far detector, the latter being deep underground in the Soudan mine. Both detectors have been taking data with cosmic rays earlier.

The 5.4 kton MINOS far detector was completed in July 2003. It has been taking data with cosmic rays and atmospheric neutrinos. Substantial progress has been made in 2004 with the NuMI beam. The near detector was completed in November 2004. The first beam from the Main Injector was delivered in December 2004, and the first events were detected in the near detector in early 2005. The first neutrino candidates from the NuMI beam were observed in the far detector in March 2005.

The committee applauds the completion of NuMI/MINOS construction in the last year and the detection of the first events both in the near and the far detectors. The sensitivity of MINOS depends on the number of protons that can be delivered. Meeting the projected goal of 2×10^{20} POT per year in FY2006 and FY2007 will be critical for MINOS to fully enter physics mode. For 2008 the goal is more than 3×10^{20} POT. While the proton delivery is discussed separately in this document (Sect. 7), we note here that a credible proton plan is the basis of the neutrino program for MINOS and a future off-axis experiment.

8.3 Future experiments: NOνA and MINERνA

The committee feels that there is a strong case for a long baseline, off axis neutrino oscillation experiment, so it is pleased that the lab is pursuing the NOνA experiment.

NOνA is surface detector with a 30 kton fully active detector. Such an experiment would be sensitive to combinations of the mixing angles θ_{13} and θ_{23}, the phase δ, and the mass squared difference Δm^2_{23}. There is also the possibility that such an experiment could determine the mass hierarchy through matter effects. Again, we refer to the recent APS neutrino study, which gave the strategy of building an off-axis detector using the existing

NuMI beam its highest recommendation.

MINERνA promises precision physics at a low cost. It will be beneficial to the overall program studying neutrino oscillations. The committee supports the design and construction of such a near detector, which is foreseen to be located in the MINOS near surface building.

8.4 General comments

The committee finds that Fermilab is conducting an impressive and coherent neutrino research program which will provide fundamental data for our understanding of neutrino physics. The formation of the neutrino department is an appropriate step to help structure this program and support the collaborations and the scientific evaluation of the experiments. It may also help to further elevate the visibility of the Fermilab effort, which ranges from providing services to the experiments to active participation in the scientific evaluation of these experiments.

9 Theoretical Particle Physics

Fermilab is fortunate to have a very strong theoretical physics group, whose members conduct forefront research on a variety of topics of relevance to the Laboratory's program. The group has strong expertise in perturbative QCD, physics beyond the Standard Model, lattice QCD, heavy-flavor physics, neutrino physics, and particle cosmology. The lattice QCD effort, in particular, has been expanded, thanks to strong support from the Department of Energy as part of the SciDac initiative. The members of the theory group are well-recognized leaders in their various areas of expertise, and many of them play a prominent role in the particle-physics community. This includes service on a variety of external committees.

The theory group provides a variety of services of great value to the Fermilab community. These include a vigorous visitor program (including the Summer Visitors and Frontier Fellows), the organization of conferences and workshops (most recently, a series of TeV4LHC workshops), and various interactions with the experimental community at the Laboratory. The committee commends recent outreach initiatives such as the new Latin American Scholars Program, which every year allows two excellent young physicists from Latin America to spend a period of six months at Fermilab to collaborate with members of the theory group.

The committee finds it unfortunate that the visitor program, being one of the most visible services the theory group offers to the Fermilab user community, has suffered significantly from recent budget cuts, in the course of which it was reduced by about 30%. This reduction should be reversed if funds become available.

While the theory group remains very successful in hiring postdoctoral researchers, there have been retention problems of junior staff in the past few years, where at least four of the Associate Scientists left the Laboratory before they could be promoted to Scientist positions. This left the group with an unhealthy age and rank distribution, which may become a threat to the future ability of the theory group to attract top-quality researchers. The committee recommends that the theory-group leadership analyze the reasons for this problematic trend and, in cooperation with the Laboratory management, identify measures for reversing it. (A possibility may be to create elite postdoctoral positions that could be converted into Associate Scientist positions, so that the most promising young researchers can be recruited from the excellent pool of postdoctoral researchers the Laboratory enjoys.)

10 Theoretical Astrophysics

The astrophysics theory group at Fermilab is very well-leveraged for its size. Besides publishing state-of-the-art theory papers, some of them are also intimately involved in analysis of experimental data for the SDSS collaboration and for various CMB experiments. These theorists are quite visible representatives of the experiments, giving invited talks and producing media-friendly sound-bites. In addition, two members of the group have independently published advanced textbooks (and one popular monograph). The theory, the analysis, the invited talks, technical and popular, and the textbook writing combine to make this small group highly effective and visible.

After the departure this year of the youngest group member, Lam Hui, for a tenured faculty position at Columbia University, the group is down to just four permanent staff. However, also this year two offers were made for new staff members. One accepted (Nick Gnedin) and one declined (Rachel Bean), the latter opting instead for a faculty position at Cornell. Gnedin works on numerical cosmological simulations, including (but not limited to) simulating galaxy formation and evolution of the intergalactic medium. This often includes quite sophisticated visualization of the simulation results, which requires serious computing skills. Intensive computer mining of large-data sets was identified one year ago as a new direction with both need and promise. It is a direction well-matched to the experimental astrophysics endeavors at Fermilab, and well-matched to the precision data now available in cosmology in general.

Given the maturity and success of the extant group, hiring a further young staff member seems warranted unless lab economics prevent it. The candidate who turned down this year's offer was an excellent choice for the lab, in terms of skills and gender-diversity. There is no reason to think that a candidate to be chosen next year cannot be of a similar high caliber.

The group enhances its size and presence at Fermilab with a prestigious Schramm Fellowship, and four additional postdoctoral fellows. The quality of these Fellows continues to be very high, as measured by papers and by subsequent job offers. In addition, two new theory offerings have been instituted by the new Particle-Astrophysics Center, to "enrich and further elevate the scientific atmosphere at the Center." They are the "Distinguished Astrophysics Visitor", offered to bring a distinguished astrophysicist to the Lab for about one month; and the "Brinson Predoctoral Fellow", offered to an outstanding PhD student in his or her final year of study. Craig Hogan and Michele Ligouri were the first recipients of these offerings.

The group is scheduled to move to the 6^{th} floor of the Wilson high-rise soon. There they will join with the astrophysics experimenters to comprise the new Particle-Astrophysics Center. The merit of this movement is the proximity it offers for the various theoretical and experimental investigations undertaken at Fermilab. It is assumed that this will help with recruitment and retention of young researchers. The disadvantage of the move is the distance it creates between the astrophysics (6^{th} floor) and particle (3^{rd} floor) theory groups; both theory groups have some overlapping interests in particle astrophysics.

One year ago the Fermilab Directorate weighed the pluses and minuses of the move and decided in favor of the move. Perhaps the Lab should next consider means to mitigate the geographic separation of the two theory groups. One example might be the institution of a joint monthly astro-particle seminar; however, given the number of seminar series already existing at Fermilab, and the present free-flow of astrophysics and particle theorists to each other's seminar series, a better idea should be sought. Perhaps the next hire could work in an area of particle-astrophysics that overlaps both groups' activities. At a minimum, postdocs of each group should be encouraged to mix with both theory groups.

11 Experimental Particle Astrophysics

By the metric of the 2003 National Academy Report, "Connecting Quarks with the Cosmos: Eleven Science Questions for the New Century," the Fermilab experimental particle astrophysics program addresses nearly half of today's fundamental issues in particle physics and particle astrophysics. If one also includes the FNAL theoretical particle astrophysics effort, this fraction climbs about 3/4. This is one clear indication that Fermilab is playing a leadership role in this exciting and burgeoning field. While talented scientists are the main reason for this happy situation, the FNAL group has also benefited from the close overlap between this field and particle physics. This will continue to give FNAL a vast pool of expertise upon which to draw.

The committee was delighted to learn that the lab has created a new Particle Astrophysics Center, with Dr. Rocky Kolb as its director. This prescient move will further strengthen Fermilab's position in the field. The committee wholeheartedly agrees with Dr. Raymond L. Orbach, Director of the DOE Office of Science, who said,

> "Like 16^{th} century astronomers who suddenly faced the proposition of a heliocentric solar system, physicists are now eager to explore what may be a second Copernican revolution. The growing and compelling confluence between cosmology and particle physics will play a crucial role in that quest. There could not be a better time to establish the Fermilab Particle Astrophysics Center, and we are delighted that Rocky Kolb has agreed to be its first Director."

The committee hopes that the new Particle Astrophysics Center will be successful in its pursuit of private funding for its telescope work, and encourages the Laboratory to provide whatever support is needed to achieve this goal.

As noted in the subsections below, the committee strongly encourages the Laboratory to capitalize on its substantial experimental particle astrophysics investments by insuring that there is sufficient manpower to analyze the valuable data these experiments provide. To that end, the committee recommends that more postdoctoral hires be made in the area of experimental particle astrophysics.

Fermilab is involved in the Sloan Digital Sky Survey (SDSS), the Pierre Auger Project, and the Cryogenic Dark Matter Search (CDMS) experiment, all of which are running and producing useful and interesting data. Fermilab is also involved in the construction of the Dark Energy Survey (DES) telescope and in R&D for the Supernova Acceleration Probe (SNAP) and the Joint Dark Energy Mission (JDEM).

11.1 Sloan Digital Sky Survey

The Sloan Digital Sky Survey recently received added funding to complete its original goal of mapping fully one-quarter of the entire sky. (It has fallen behind schedule due primarily to poor weather.) With over 20 papers in 2004 alone, the SDSS collaboration has been extremely productive, and a number of their discoveries have been widely cited and publicized, such as the recent first observation of cosmic magnification, an effect predicted by General Relativity.

The Fermilab group's principal contribution to the SDSS has been to process all the data acquired by the telescope. The group wins very high marks from the SDSS collaboration for the job they have done, and the committee congratulates the Fermilab SDSS collaborators for making such a crucial contribution to the success of this high-profile experiment. The committee fully supports Fermilab's continued participation in SDSS.

The committee urges Fermilab management to do everything it can to reap the benefits of many years of experience and knowledge accumulated by the Fermilab group on SDSS. In particular, the committee would like to see Fermilab management increase the postdoctoral applicant pool for SDSS so that the lab can perform more data analysis and, hopefully, make and get credit for new high-profile discoveries.

11.2 Pierre Auger Project

The Pierre Auger project will garner the first-ever high statistics sample of extremely energetic cosmic-rays. These particles, with macroscopic energies hovering around one joule, are mysterious in origin, production and composition. With an array of surface detectors ultimately covering 3000 km^2, and with fluorescence detectors operating in tandem (on dark nights), Auger is poised to resolve at least some of the mystery behind these enigmatic astronomical messengers. The committee eagerly awaits first physics results, which are due in mid-2005.

The principal contributions of Fermilab to the Auger project have been in project management and in detector design, development, and production supervision. Project management is a very difficult task to perform while keeping (nearly) everyone happy, yet Paul Mantsch and the Fermilab group appear to have done just that. The committee is very pleased with this accomplishment, and urges the Laboratory to continue to support the Fermilab Auger group so that it can continue to make this highly valued contribution. The committee was also pleased to learn that Mantsch will be giving a keynote talk at the upcoming International Cosmic Ray Conference in India in summer 2005.

The Auger South detector in Argentina has roughly 1/3 of its surface detectors deployed, and about 1/2 of its fluorescence detector telescopes built. The committee is pleased to recognize the Fermilab engineering contributions that made this possible. Auger groups are gearing up now to plan for a possible northern companion to Auger South. The committee encourages Laboratory management to ensure that Fermilab is positioned to play a key role in the design and construction of Auger North.

Given the unusually high number of institutions on Auger, it seems conceivable for a group of modest size (a few senior scientists, several postdocs and graduate students) to make a major impact on the analysis of Auger data. As with SDSS, Fermilab ought to be sure to build upon its existing investment in Auger by supporting the hiring of an adequate number of postdocs and graduate students to perform analysis of Auger data.

11.3 Cold Dark Matter Search

In the set of particle astrophysics experiments being pursued at Fermilab, the physics addressed by the Cold Dark Matter Search experiment has perhaps the most direct overlap with the central particle physics mission of the lab. Built for direct detection of dark matter, CDMS is searching for a conjectured weakly interacting massive particle (WIMP) using cryogenically-cooled stacks of silicon and germanium. The Fermilab group on CDMS has made substantive contributions to the engineering required to build the experiment, and recently has hired a new postdoc, ramping up the FNAL involvement in data analysis. Fermilab scientists are also involved in the R&D work for Super-CDMS, a phased enlargement of CDMS culminating in a device with roughly 1000 times the sensitivity of the current one.

It is worth stating the obvious here: The discovery of WIMP dark matter by CDMS or Super-CDMS would eclipse any particle physics discovery of the past decade or more. Some may consider CDMS and its approach complementary to that of accelerator-based experiments, but in reality CDMS is doing mainstream particle physics. As such, it sits squarely in the heart of the mission of the Laboratory, and clearly deserves the continued full support of Fermilab management.

The CDMS collaboration recently announced new results that are fully an order of magnitude more sensitive to WIMP dark matter than those of Edelweiss, the nearest competitor. These results also almost completely rule out the positive signal claimed by the DAMA experiment. The committee congratulates the Fermilab CDMS group for its key contributions to the design and construction of CDMS, and urges the lab to increase the postdoctoral applicant pool for particle astrophysics so that the Fermilab CDMS group can perform more CDMS data analysis.

11.4 Dark Energy Survey

The Dark Energy Survey is a survey of 5000 square degrees of the southern galactic cap. Its aim is to study the evolution of dark energy through red-shift measurements of galactic-cluster surveys. Twelve Fermilab scientists (3-4 FTE's) are making a major contribution by designing and building a mosaic-imaging camera for the 4m telescope at the Cerro Tololo Interamerican Observatory (CTIO) in Chile.

Fermilab is the largest institution in this collaboration (but they are less than 1/2 of the total). Experience gained working with the SDSS data should help Fermilab scientists with the analysis of DES data once construction is completed in 2009. The committee applauds the major role being played by Fermilab in DES and encourages Fermilab management to insure that this continues to be the case once the telescope comes online.

11.5 Supernova Acceleration Probe and Joint Dark Energy Mission

SNAP is an R&D effort headed at LBNL and supported by DOE that will probably morph into Joint Dark Energy Mission once both NASA and DOE become involved. The scientific goal is to explore dark energy using type Ia supernovae as standard candles to measure the rate of the expansion of the universe, and from that measurement infer useful information about the evolution of dark energy.

Fermilab scientists are already deeply involved in this effort, with about 15 people (about 4 FTE's) involved in the R&D effort, making Fermilab perhaps the second largest collaborating institution. Josh Frieman of the FNAL Theoretical Astrophysics group is a member of the SNAP Collaboration Board, giving Fermilab a voice in major decisions.

Right now, the time scale for SNAP/JDEM is "beyond the budget horizon." Given the high profile of this experiment and the exciting physics it will address, the committee strongly supports continued commitment to the R&D effort on SNAP at Fermilab.

12 Computing R&D

The R&D activities of the Computing Division are focused in three main areas. Tightly coupled computing will provide the computing power needed make further progress on lattice QCD calculations. Developing advanced simulation tools, based on C++, to make progress on improving the performance of existing accelerators, and on the detailed design of advanced accelerators, is key to making progress in particle physics research. Work on enabling technologies to take advantage of Grid computing will be essential to be able to analyze the massive amounts of data that will be produced by the LHC detectors when the LHC is operating at full luminosity. These three areas fit naturally into the strengths of the Computing Division personnel.

The rapid decrease in the price/performance index in commodity computing promises to bring this index down to $1/Mflop by 2006. This will make possible clusters capable of several Tflop performance for lattice QCD calculations. With these clusters, QCD parameters associated with the CKM matrix can be calculated to the few % level. These will be at the same level as the uncertainties of the best data from experiments.

The software framework "Synergia," developed to provide a tightly coupled coding environment for simulation of instruments, follows the techniques that have been very successful in experimental particle physics. Using this approach, the ion profile monitor detector system in the Fermilab Booster has been accurately simulated, including the halo components of the beam. This has allowed better control of particle losses which limit the performance of the Booster because of induced radioactivity. This will be an important tool for understanding electron cooling, beam-beam effects, and other space charge effects in accelerators.

The development of middleware to make effective use of grid computing resources is going well. The efforts of the group to develop standards and protocols through the open science grid consortium to make all of the grid projects usable are an important contribution. There still remain areas of incompatibilities with the European grids, and increased effort may be needed to resolve these.

Overall, the computing division at Fermilab is to be commended for provided the computing resources needed to analyze the very large quantities of data coming from CDF and D0 in an efficient, reliable and cost effective manner. At the same time, the division is carrying out a well focused and much needed R&D program for the future. This speaks well of the management and personnel of the division.

13 Physics Case for the Proton Driver

Few unexpected fundamental particle physics phenomena have been discovered in the last few decades; the most important new knowledge has involved the nature of neutrinos. The existence of nonzero neutrino masses and the mixing of the members of the three neutrino families were unanticipated in the Standard Model. These facts, now clearly established, have far reaching implications. The present description involves a "mixing matrix" that includes three angles, a phase, and three mass parameters. Combinations of the mass parameters and two of the angles are reasonably well measured. Still unknown are the remaining angle (θ_{13}), the CP phase describing violation of particle-antiparticle symmetry, and the ordering of the masses from lowest to highest by lepton family.

Thus far, only an upper limit is established for third angle, θ_{13} ($\sin^2 2\theta_{13} < 0.1$): if this parameter is finite, the questions of CP and mass orderings may be investigated. Presently operating experiments are expected to only modestly improve the search range for θ_{13}. However, a newly approved FNAL experiment (NOνA) should provide a much larger region of exploration based on the existing substantial investment in the NuMI beam line. In addition, if the value of θ_{13} were found to be nonzero, continued investment will permit pursuing the fundamental issues of mass ordering and particle-antiparticle symmetry in the neutrino sector. Though there are competitors to first address these physics issues, particularly in Japan, the appropriately energetic high intensity NuMI neutrino beam provides unique opportunities. Experiments that might be performed in other parts of the world and at reactors complement those at Fermilab. If θ_{13} is large enough, the NuMI facility would provide particularly unique opportunities for investigation of the neutrino mass hierarchy.

The most severe potential limitation to making such discoveries is the rate of neutrino detection at the large distances required for the detector. Hence, it is appropriate to anticipate the need for about an order-of-magnitude increase in neutrino intensity over the next decade by pursuing R&D so as to improve the targeted proton beam intensity creating the meson parents of the neutrinos. To obtain this intensity increase, the Laboratory is concentrating on a "Proton Driver". One option for this machine is a linac of 8 GeV energy and 2 Megawatts of beam power, to replace the presently limiting Booster complex. The fact that such a linac would utilize superconducting RF cavities very similar to those being developed for the International Linear Collider is also likely to make such R&D more cost effective.

Arguments are made for other interesting experiments that could be performed with higher proton intensity. These include more detailed measurements of low energy neutrino- and antineutrino-nucleon scattering than have been performed to date: such measurements are interesting in their own right but also may be important for interpretation of oscillation experimental results. Additionally, experiments on rare decays of kaons and muons, as well as tests of mixing of charged muons with electrons at extraordinary levels of sensitivity, become possible.

14 ILC Detector R&D

A worldwide consensus has emerged that the next large facility in particle physics should be an international high energy electron-positron Linear Collider. The recent choice of the cold technology, the initiation of the Global Design Effort, and the appointment of Barry Barish to lead this team, necessitates a step up in the detector R&D and design. Since it is also clear that, if the ILC will be in the U.S., it will be hosted by Fermilab, it is critical that Fermilab play an important role not only in the design of the accelerators but also in the detector R&D.

- The committee applauds the increase in leadership in ILC detector activities emerging at Fermilab. We are pleased that the lab is participating both in generic ILC detector R&D and detector specific development. We are especially impressed with the collaboration which has been established between Fermilab and SLAC to bring the SiD detector concept into a detailed detector technical design report.

- The committee would like to see a more focused and prioritized effort on the critical areas of detector R&D such as the vertex detector technology for flavor identification, and the energy flow calorimetry for good jet resolution.

  - The ASIC group at Fermilab has an excellent record of readout chip development. Their expertise would enable a strong U.S. R&D program for ILC vertex detectors, which could include the development of CMOS based monolithic pixels or DEPFET. They could also have a major impact on the efforts to improve the clocking speed of CCDs to 50 MHz, which is necessary for the bunch structure of a cold collider.

  – We recommend developing collaborations between the silicon tracking and the Silicon-Tungsten calorimeter communities to address common issues and problems.

- There is an excellent synergy for the Fermilab group to be deeply involved in the interface between machine and detector. We are pleased to see that a strong simulation effort has been started.

- We believe that Fermilab has a mission to support the ILC detector R&D which is carried out by the university groups by providing test beam facilities.

15 Fermilab Users' Group

The committee heard a presentation on the activities of the Fermilab Users' Group, given by the Chair of the Fermilab Users' Executive Committee (UEC). The UEC provides a forum for users to discuss their concerns with the Laboratory, provides feedback on scientific and administrative matters, gathers information from and for the community, organizes an annual trip to Washington, and interfaces with Users' Groups at other labs.

The UEC Chair noted that the last year has been very good for the Laboratory, with excellent performance by the Collider and a start on a dynamic new neutrino program. Defining the Laboratory's longer range future remains a challenging task.

During the past year, the UEC has carried out two surveys of the user community, one on foreign users and one on quality of life. The survey on foreign users provided feedback on visa concerns which was communicated to URA and DOE. The quality of life survey looked at housing, transportation, and the cafeteria.

In collaboration with the SLAC users' group, the UEC also organized a trip to Washington, in which 134 Congressional offices were visited, along with OMB/OSTP, DOE, and NSF. The focus of the message was on long term funding, and the need for training of students and postdocs.

The committee supports the activities of the UEC, both those focused on local concerns, and those of more national scope, which are shared with other laboratory's users' groups. The committee encourages the engagement of the users, in particular students and postdocs, in discussions with the Laboratory on its long-range future. This future is most important to the younger members of the community, and they should have a voice in the discussions which shape future plans.

A Charge to the 2005 URA Visiting Committee for Fermilab

Although Fermilab is a single mission Laboratory, its present scientific program is quite broad. It includes both collider and neutrino oscillation experiments, and the necessary accelerator operations and R&D for improving the existing accelerator complex. In addition, Fermilab plays a leading role in U.S. participation in the LHC, both on the accelerator side and in the CMS detector. The Laboratory also has an advanced accelerator R&D program for future accelerators, a program in experimental astrophysics, and theoretical programs both in particle physics and astrophysics. The URA Visiting Committee for Fermilab is charged with reviewing this scientific program and commenting on its quality, soundness, overall balance, and future prospects. The Committee is also encouraged to comment on the Laboratory Directors plans and priorities for Fermilab.

In its response to this charge, the URA Visiting Committee should try to address the following points:

i) How effectively is the Laboratory dealing with Collider Run II issues (both accelerator and detector performance)? How realistic are the Laboratory's Run II goals in relation to current and expected collider performance?

ii) How effectively is the Laboratory meeting the requirements of the MiniBooNE and MINOS neutrino experiments?

iii) Are the Laboratory's R&D and long-range planning activities appropriately matched to future opportunities, especially in view of the technology decision for the proposed International Linear Collider?

iv) Is the Laboratory's astrophysics program evolving in a coherent manner?

v) Is the Fermilab program competitive at the world level, both in its broad scope and in the quality of its individual components? Are there any individual components which fall short of this standard?

vi) Is the balance in the Laboratory between current programs and research and planning for future programs appropriate? Notwithstanding current budget difficulties, are adequate resources being applied to high priority activities?

vii) Are there areas of scientific endeavor where Fermilab could have a significant impact, which the Laboratory should pursue more vigorously? Are there programs in the Laboratory whose efforts require future review in order to determine whether they should continue?

viii) Have recent permanent staff appointments at Fermilab helped further the mission of the Laboratory? Are there areas that are missing key people and which could be strengthened?

ix) Does the Laboratory management provide the scientific leadership needed for Fermilab?

x) Does Fermilab provide the administrative, technical and scientific support needed by its users?

xi) Is the programmatic support for Fermilab's scientific mission adequate and are the Laboratory resources used effectively? Are there efforts which should be commended and/or are there opportunities for improvement in specific areas?

xii) Are there any particular issues requiring special attention by URA?

B Agenda

April 22, 2005

8:00	Executive Session	
8:30	Fermilab Overview and Strategic Issues (50+10 min)	M. Witherell
9:30	Run II Plan (20+10 min)	P. Bhat
10:00	ILC and Fermilab Accel. R&D Strategy (35+10 min)	R. Kephart
10:45	Break	
11:00	D0 Research Program (30+10 min)	D. Denisov
11:40	CDF Research Program (30+10 min)	D. Glenzinski
12:20	U.S. CMS Research Program (30+10 min)	D. Green
1:00	Lunch	
2:00	Proton Plan (25+10 min)	E. Prebys
2:35	Neutrino Physics Program Overview (40+10 min)	G. Rameika
3:25	Break	
3:45	Theoretical Particle Physics (20+10 min)	C. Hill
4:15	Theoretical Astrophysics (20+10 min)	A. Stebbins
4:45	Experimental Particle Astrophysics (30+10 min)	E. Kolb
5:25	Executive Session	
6:30	Leave for Dinner	

April 23, 2005

8:30	Computing Strategies (30+10 min)	R. Tschirhart
9:10	Physics Case for the Proton Driver (30+10 min	S. Geer
9:50	Break	
10:15	Proton Driver Overview (35+10 min)	W. Foster
11:00	ILC Detector R&D (20+10 min)	H. Weerts
11:30	Users Executive Committee Report (20+10 min)	W. Trischuk
12:00	Working Lunch	
1:00	Executive Session	
3:30	Closeout with Laboratory Management	
4:30	Adjourn	